Statisztikus Fizika Szemináriumok

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Exoplanetary mass constraints based on topology of interacting networks

The continuously increasing number of newly discovered worlds outside of our own solar system requires as precise as possible parameter estimations such as planetary masses, orbital characteristics, bulk density, etc. Comprehensive statistical methods and inverse dynamical analyses have been worked out to obtain system parameters from astronomical observations. Nevertheless, the time domain measurements as scalar time series transformed into complex networks serve a powerful tool to investigate dynamical systems via network topology. Many recent works make significant effort to explore the causality relations and coupling directions between connected dynamical systems.

In this talk a new estimation procedure of planetary masses is presented making use of eclipse time variation in multi-planetary systems. Due to the gravitational coupling the motion of planets differs from pure Keplerian ellipse resulting in variable orbital periods. Measuring this tiny effect for nearly co-planar planets one is able to reconstruct the trajectories sharing the same phase space. Transforming then the obtained state vectors of the entangled dynamical systems into network representation, it can be shown that the coupling directions between the interacting sub-networks are related to planetary masses relative to each other.